

APPENDIX C

RIPARIAN CANOPY ASSESSMENT

This appendix presents the information regarding two separate but associated riparian canopy assessments conducted along Prospect Creek during 2004 and 2005. Health and maturity of riparian corridors have a direct impact on stream morphology and habitat, sediment loading, and stream temperature. The information in this appendix also provides a reference to compare future riparian studies against. The results of the riparian canopy assessment provide the rationale for the riparian canopy targets presented in **Section 4.0**.

Introduction

Riparian areas perform many ecological functions that contribute to overall stream health. The vegetation within riparian areas helps to: stabilize streambanks, dissipate energy of floods, support perennial flows, trap sediment, and moderate stream temperature (Gregory et al., 1991; Elmore and Kauffman, 1994; Gurnell, 1997; Naiman and Decamps, 1997; Tabacchi et al., 1998; Tabacchi et al., 2000). Many of these functions are important for maintaining wildlife habitat, especially for endangered salmonids (see reviews by Kauffman and Krueger, 1984; Platts, 1991; Fitch and Adams, 1998; Naiman et al., 2000).

The history of resource extraction, the development of infrastructure, and the inhabitation of river valleys for residence and livelihood have impacted riparian corridors throughout Montana. The Prospect Creek watershed is no exception. Roads and utility corridors route through many stream bottoms and have altered not only the riparian composition but stream channel form and in-stream habitat as well. Agricultural and residential development in the watershed has also affected riparian health, all of which have decreased water quality and habitat conditions throughout the Prospect Creek watershed.

The following assessments were developed to investigate the current conditions of the riparian community along Prospect Creek, identify areas for potential improvement, and provide a baseline for subsequent study. An initial analysis of aerial photos was conducted to remotely identify general riparian community composition for Prospect Creek mainstem. A subsequent study was conducted in the field to verify the accuracy of the aerial photo interpretation, and correlate the aerial photo analysis results to observed conditions.

Aerial Photo Analysis

Methods

Canopy density analysis for the mainstem Prospect Creek was completed using the 1996 aerial photo series at a scale of 1 inch equals 300 feet. The analysis includes Reaches 2 through 5 and did not include Reach 1, a higher gradient B channel. Reach 1 is characterized by a confined channel in a steep canyon that terminates at the confluence with the Clark Fork River. Sampling locations for remote analysis were established in each stream reach, at equal intervals, enabling a minimum of 30 measurements. A map wheel determined exact sampling locations along the

mainstem where a planimeter-type grid, one inch square, with 41 holes was overlain on selected sites. This grid was orientated perpendicular to valley aspect, and encompassed the adjacent floodplain and bankfull channel with plot size determined by local meander belt width. When increased belt widths occurred, the grid size was enlarged to meet the additional area. The grid size was narrowed when the belt width decreased.

Within each selected site, the percent of forested (mature forest and thick willow/alder) land was derived by tallying the number of dots overlying forested areas and dividing by the total number of dots within the plot. Adjacent or influencing anthropogenic land uses were identified when present. Each site was mapped and numbered on the relevant aerial photo.

Data

Table C-1. Land Ownership, Land Uses, and Vegetation Class Associated with Percent Canopy Derived from 1996 Aerial Photo Interpretation Reported in RDG 2004

				Left Bank					Right Bank					
Reach	Site	# of Threads	Total Active Channel Width (feet)	Land Owner	Land Use 1	Land Use 2	Land Use 3	Vegetation	Land Owner	Land Use 1	Land Use 2	Land Use 3	Vegetation	Percent Canopy
2	1	2	150	pvt	NWE	highway		shrub/ small trees	pvt				shrub/ small trees	46
2	2	2	220	pvt	NWE	road	highway	mature trees	pvt	NWE	Restoration attempt		shrub/ small trees	47
2	3	1	100	pvt	highway			shrub/ small trees	pvt				shrub/ small trees	39
2	4	1	120	pvt	highway			bare ground/ grass/ shrub	pvt	road			bare ground/ grass	27
2	5	1	210	pvt	highway			bare ground/ grass/ shrub	pvt	BPA			shrub/ small trees	30
2	6	2	150	pvt	BPA	highway		mature trees	pvt	BPA			shrub/ small trees	68
2	7	1	130	USFS	highway			shrub/ small trees	fs	YPL (original)	NWE	road	shrub/ small trees	74
2	8	2	150	fs	highway			shrub/ small trees	fs				shrub/ small trees	74
2	9	1	90	fs	highway			bare ground/ grass	fs				mature trees	71
2	10	3	300	pvt	highway			shrub/ small trees	pvt	YPL (original)	NWE		shrub/ small trees	41
2	11	1	150	pvt	highway			shrub/ small trees	pvt	YPL (original)			shrub/ small trees	52
2	12	1	150	pvt	highway			bare ground/ grass	pvt	YPL (original)			shrub/ small trees	58

Table C-1. Land Ownership, Land Uses, and Vegetation Class Associated with Percent Canopy Derived from 1996 Aerial Photo Interpretation Reported in RDG 2004

				Left Bank					Right Bank					
Reach	Site	# of Threads	Total Active Channel Width (feet)	Land Owner	Land Use 1	Land Use 2	Land Use 3	Vegetation	Land Owner	Land Use 1	Land Use 2	Land Use 3	Vegetation	Percent Canopy
2	13	2	180	pvt	highway			bare ground/ grass	pvt	YPL (original)			shrub/ small trees	64
2	14	3	210	pvt	highway			shrub/ small trees	pvt	YPL (original)			grass/ shrub	44
2	15	1	165	pvt	highway			grass/ shrub/ small trees	pvt	YPL (original)			shrub/ small trees	39
2	16	1	100	pvt	highway			bare ground/ grass	pvt	YPL (original)	NWE		shrub/ small trees	68
2	17	3	300	pvt	NWE	highway		bare ground/ grass/ shrub	pvt	YPL (original)	NWE		shrub/ small trees	61
2	18	1	135	pvt	YPL (original)			mature trees	pvt				mature trees	77
2	19	1	150	pvt	road			mature trees	pvt	road			shrub/ small trees	74
2	20	1	150	pvt	road			shrub/ small trees	pvt	road			mature trees	68
2	21	2	150	pvt				shrub/ small trees	pvt	road			shrub/ small trees	81
2	22	2	170	pvt	residence			shrub/ small trees	pvt	residence	riparian development		bare ground/ grass	52
2	23	3	120	pvt				shrub/ small trees	pvt				mature trees	64
2	24	4	350	pvt	riparian	road	residence	bare	pvt				mature	55

Table C-1. Land Ownership, Land Uses, and Vegetation Class Associated with Percent Canopy Derived from 1996 Aerial Photo Interpretation Reported in RDG 2004

				Left Bank					Right Bank					
Reach	Site	# of Threads	Total Active Channel Width (feet)	Land Owner	Land Use 1	Land Use 2	Land Use 3	Vegetation	Land Owner	Land Use 1	Land Use 2	Land Use 3	Vegetation	Percent Canopy
					development			ground/ grass/ shrub					trees	
2	25	2	225	pvt				shrub	pvt				shrub/ small trees	63
2	26	2	350	pvt	residence	highway	NWE	shrub	pvt				shrub/ small trees	49
2	27	1	120	pvt	highway	NWE		shrub/ small trees	pvt				mature trees	49
2	28	1	210	pvt	highway	NWE		bare ground/ grass/ shrub	pvt				mature trees	37
2	29	3	200	pvt	highway	NWE		shrub	pvt				shrub/ small trees	51
2	30	2	375	pvt	residence	riparian development		shrub/ small trees	pvt				shrub/ small trees	60
2	31	1	225	pvt				small trees	pvt				shrub/ mature trees	68
3	1	1	120	pvt				shrub/ small trees	pvt				mature trees	77
3	2	2	300	pvt	residence	riparian development		grass/ shrub/ small trees	pvt				shrub/ small trees	49
3	3	1	150	fs/ pvt				shrub/ small trees	fs/ pvt				mature trees	72
3	4	1	120	fs	YPL (original)	highway	YPL (re- route)	bare ground/ grass/ shrub	fs	YPL (original)			shrub/ small trees	54

Table C-1. Land Ownership, Land Uses, and Vegetation Class Associated with Percent Canopy Derived from 1996 Aerial Photo Interpretation Reported in RDG 2004

				Left Bank					Right Bank					
Reach	Site	# of Threads	Total Active Channel Width (feet)	Land Owner	Land Use 1	Land Use 2	Land Use 3	Vegetation	Land Owner	Land Use 1	Land Use 2	Land Use 3	Vegetation	Percent Canopy
3	5	1	180	fs	YPL (original)			grass/ shrub/ small trees	fs	YPL (original)			shrub/ small trees	61
3	6	3	90	pvt				shrub/ small trees	pvt				shrub/ small trees	68
3	7	1	100	fs	pasture			grass/ shrub/ small trees	fs				mature trees	21
3	8	2	300	pvt	YPL (original)	NWE	riparian development	grass/ shrub/ small trees	pvt				shrub/ small trees	59
3	9	2	160	fs	YPL (original)	NWE		shrub/ small trees	fs				mature trees	54
3	10	1	225	pvt	highway	YPL (re-route)		bare ground/ grass	fs	NWE	YPL (original)		bare ground/ grass/ shrub/ mature trees	56
3	11	2	120	fs	YPL (original)	NWE		shrub/ small trees	fs				shrub/ small trees	76
3	12	2	190	pvt				shrub/ small trees	pvt				mature trees	72
3	13	2	375	pvt	residence	NWE	YPL (re-route)	bare ground/ grass/ shrub	pvt				shrub/ small trees	35
3	14	1	95	pvt				shrub/ small trees	pvt				mature trees	75

Table C-1. Land Ownership, Land Uses, and Vegetation Class Associated with Percent Canopy Derived from 1996 Aerial Photo Interpretation Reported in RDG 2004

				Left Bank					Right Bank					
Reach	Site	# of Threads	Total Active Channel Width (feet)	Land Owner	Land Use 1	Land Use 2	Land Use 3	Vegetation	Land Owner	Land Use 1	Land Use 2	Land Use 3	Vegetation	Percent Canopy
3	15	2	135	pvt				geadss/ shrub/ small trees	pvt				mature trees	66
3	16	3	110	pvt				shrub/ small trees	pvt				mature trees	71
3	17	2	120	fs	pasture			bare ground/ grass/ shrub	fs				mature trees	43
3	18	2	150	fs				mature trees	fs				shrub/ mature trees	74
3	19	1	225	fs	NWE	highway	YPL (re-route)	grass/ mature trees	fs	NWE	YPL (original)		grass/ shrub/ small trees	58
3	20	2	225	fs	highway	YPL (re-route)		bare ground/ grass/ shrub	fs	NWE			bare/ shrub/ small trees	64
3	21	1	100	fs	NWE	YPL (original)	road	bare ground/ grass	fs	road			mature trees	39
3	22	1	200	fs	YPL (original)			bare ground/ grass/ shrub	fs	NWE			shrub/ small trees	38
3	23	1	120	pvt	road	residence	riparian development	grass/ shrub/ small trees	pvt				small/ mature trees	31
3	24	1	95	fs	highway	YPL (re-route)		bare ground/	fs	NWE			shrub/ small trees	45

Table C-1. Land Ownership, Land Uses, and Vegetation Class Associated with Percent Canopy Derived from 1996 Aerial Photo Interpretation Reported in RDG 2004

				Left Bank					Right Bank					
Reach	Site	# of Threads	Total Active Channel Width (feet)	Land Owner	Land Use 1	Land Use 2	Land Use 3	Vegetation	Land Owner	Land Use 1	Land Use 2	Land Use 3	Vegetation	Percent Canopy
								grass						
3	25	1	210	fs	NWE	YPL (original)		shrub/ small trees	fs	NWE	YPL (original)		shrub/ small trees	58
3	26	2	190	fs	NWE	YPL (re-route)	highway/ BPA	shrub/ small trees	fs	NWE			grass/ shrub/ small trees	56
3	27	1	150	fs	YPL (original)			shrub/ small trees	fs				shrub/ small trees	65
3	28	1	120	fs				bare ground/ grass/ shrub	fs	YPL (original)	YPL (original)		grass/ shrub/ small trees	64
3	29	1	100	fs				bare ground/ grass/ shrub	fs	YPL (original)			grass/ shrub/ small trees	44
3	30	2	75	fs				shrub/ small trees	fs				shrub/ mature trees	71
3	31	3	65	fs				bare ground/ grass/ shrub	fs				shrub/ small trees	42
3	32	1	150	fs	fire			grass/ shrub/ small trees	fs	fire			shrub/ small trees	47
4	1	2	250	fs				bare ground/ grass	fs				mature trees	25

Table C-1. Land Ownership, Land Uses, and Vegetation Class Associated with Percent Canopy Derived from 1996 Aerial Photo Interpretation Reported in RDG 2004

				Left Bank					Right Bank					
Reach	Site	# of Threads	Total Active Channel Width (feet)	Land Owner	Land Use 1	Land Use 2	Land Use 3	Vegetation	Land Owner	Land Use 1	Land Use 2	Land Use 3	Vegetation	Percent Canopy
4	2	3	180	fs				bare ground/ grass/ shrub	fs				grass/ mature trees	32
4	3	3	250	fs				shrub/ small trees	fs	YPL (original)			grass/ shrub/ small trees	34
4	4	1	180	fs				shrub/ mature trees	fs	YPL (original)			shrub/ shrub/ small trees	46
4	5	2	195	fs				shrub/ small trees	fs	YPL (original)			grass/ shrub	26
4	6	3	225	fs				grass/ shrub/ small trees	fs	YPL (original)			grass/ shrub/ small trees	18
4	7	3	300	fs					fs	YPL (original)	road	riparian development	bare/ grass/ shrub	17
4	8	2	300	fs				bare ground/ grass/ shrub	fs	road	YPL (original)	NEW	bare/ grass/ shrub	14
4	9	2	300	fs				mature trees	fs	road	NWE	YPL (original)	grass/ shrub/ small trees	25
4	10	2	270	fs				shrub/ mature trees	fs	road	NWE	YPL (original)	grass/ shrub	31
4	11	2	200	fs				mature trees	fs	road	NWE	YPL (original and re-route)	grass/ shrub	25

Table C-1. Land Ownership, Land Uses, and Vegetation Class Associated with Percent Canopy Derived from 1996 Aerial Photo Interpretation Reported in RDG 2004

				Left Bank					Right Bank					
Reach	Site	# of Threads	Total Active Channel Width (feet)	Land Owner	Land Use 1	Land Use 2	Land Use 3	Vegetation	Land Owner	Land Use 1	Land Use 2	Land Use 3	Vegetation	Percent Canopy
4	12	1	225	fs	riparian development			grass/ shrub/ small trees	fs	riparian development	NWE	YPL (original and re-route)	bare/ grass/ shrub	28
4	13	1	120	fs				shrub/ small trees	fs				shrub/ small trees	46
4	14	2	70	fs	road			bare ground/ grass/ shrub	fs	road			shrub/ mature trees	44
4	15	1	90	fs				grass/ shrub/ small trees	fs				grass/ shrub/ small trees	39
4	16	1	105	fs				mature trees	fs				shrub/ small trees	41
4	17	1	120	fs				mature trees	fs				mature trees	54
4	18	2	135	fs				mature trees	fs				mature trees	39
4	19	2	115	fs				mature trees	fs				mature trees	52
4	20	1	115	fs				mature trees	fs				mature trees	61
4	21	1	135	fs				mature trees	fs	YPL (original)	road	highway	shrub/ small trees	34
4	22	1	90	fs				mature trees	fs	YPL (original)	road		grass/ mature trees	61
4	23	2	75	fs				mature trees	fs				mature trees	90

Table C-1. Land Ownership, Land Uses, and Vegetation Class Associated with Percent Canopy Derived from 1996 Aerial Photo Interpretation Reported in RDG 2004

				Left Bank					Right Bank					
Reach	Site	# of Threads	Total Active Channel Width (feet)	Land Owner	Land Use 1	Land Use 2	Land Use 3	Vegetation	Land Owner	Land Use 1	Land Use 2	Land Use 3	Vegetation	Percent Canopy
4	24	1	65	fs				mature trees	fs				mature trees	90
4	25	1	75	fs				mature trees	fs				mature trees	71
4	26	2	90	fs				mature trees	fs				grass/ mature trees	63
4	27	2	110	pvt	riparian clearing	road		bare ground/ grass/ shrub	pvt	riparian development			grass/ shrub/ small trees	32
4	28	2	105	fs				mature trees	fs				mature trees	76
4	29	2	150	fs				shrub/ small trees	fs	YPL (original)			mature trees	49
4	30	2	190	fs				shrub/ small trees	fs	YPL (original)			shrub/ small trees	40
5	1	1	40	pvt	YPL (original)			mature trees	pvt	riparian development	road	YPL (original)	mature trees	59
5	2	2	80	fs/ pvt	riparian clearing	road		grass/ shrub	fs/ pvt	YPL (original)			shrub/ mature trees	53
5	3	1	60	fs				mature trees	fs	YPL (original)	YPL (re-route)		mature trees	56
5	4	1	50	fs				mature trees	fs				shrub/ mature trees	53

Table C-1. Land Ownership, Land Uses, and Vegetation Class Associated with Percent Canopy Derived from 1996 Aerial Photo Interpretation Reported in RDG 2004

				Left Bank					Right Bank					
Reach	Site	# of Threads	Total Active Channel Width (feet)	Land Owner	Land Use 1	Land Use 2	Land Use 3	Vegetation	Land Owner	Land Use 1	Land Use 2	Land Use 3	Vegetation	Percent Canopy
5	5	1	75	fs				mature trees	fs				shrub/ small trees	50
5	6	2	50	fs				mature trees	fs				mature trees	57
5	7	1	40	fs				bare ground/ grass/ mature trees	fs				mature trees	43
5	8	2	40	fs				mature trees	fs				shrub/ small trees	50
5	9	1	45	fs				mature trees	fs				mature trees	61
5	10	2	90	fs				mature trees	fs	YPL (original)	highway	YPL (re-route)	grass/ shrubs/ mature trees	56
5	11	1	75	fs				shrub/ small trees	fs	YPL (original)	highway	YPL (re-route)	grass/ shrub/ small trees	16
5	12	1	75	fs				shrub/ small trees	fs	YPL (original)			shrub/ small trees	31
5	13	2	100	fs	YPL (original)			shrub/ small trees	fs	YPL (original)	highway		shrub/ small trees	53
5	14	1	90	fs				mature trees	fs	YPL (original)	highway	YPL (re-route)	grass/ shrub/ small trees	53

Table C-1. Land Ownership, Land Uses, and Vegetation Class Associated with Percent Canopy Derived from 1996 Aerial Photo Interpretation Reported in RDG 2004

				Left Bank					Right Bank					
Reach	Site	# of Threads	Total Active Channel Width (feet)	Land Owner	Land Use 1	Land Use 2	Land Use 3	Vegetation	Land Owner	Land Use 1	Land Use 2	Land Use 3	Vegetation	Percent Canopy
5	15	1	90	fs	YPL (original)	highway	YPL (re-route)	bare ground/ grass/ shrub	fs	YPL (original)	YPL (re-route)	highway	shrub/ small trees	30
5	16	1	30	fs	YPL (original)			grass/ small trees	fs				mature trees	57
5	17	1	30	fs				mature trees	fs				mature trees	87
5	18	1	20	fs				mature trees	fs				mature trees	87
5	19	1	25	fs				shrub/ mature trees	fs				mature trees	74
5	20	1	45	fs	YPL (original)	highway	YPL (re-route)	grass/ mature trees	fs				mature trees	78
5	21	1	20	fs	YPL (original)	highway	YPL (re-route)	bare ground/ grass	fs				mature trees	50
5	22	1	20	fs	YPL (original)	highway	YPL (re-route)	grass/ shrub/ small trees	fs				mature trees	50
5	23	1	20	fs	YPL (original)	highway	YPL (re-route)	grass/ shrub/ small trees	fs				mature trees	64
5	24	1	55	fs	highway	YPL (re-route)		bare ground/ grass	fs	YPL (original)			shrub/ small trees	43

Table C-1. Land Ownership, Land Uses, and Vegetation Class Associated with Percent Canopy Derived from 1996 Aerial Photo Interpretation Reported in RDG 2004

				Left Bank					Right Bank					
Reach	Site	# of Threads	Total Active Channel Width (feet)	Land Owner	Land Use 1	Land Use 2	Land Use 3	Vegetation	Land Owner	Land Use 1	Land Use 2	Land Use 3	Vegetation	Percent Canopy
5	25	1	30	fs	highway	YPL (re-route)		bare ground/ grass/ shrub	fs	YPL (original)			shrub/ mature trees	50
5	26	1	30	fs	highway	YPL (re-route)		bare ground/ grass/ shrub	fs	YPL (original)			shrub/ small trees	50
5	27	2	45	fs	YPL (original)			shrub/ small trees	fs	YPL (original)			mature trees	43
5	28	1	25	fs	YPL (original)	highway	YPL (re-route)	grass/ shrub/ small trees	fs				mature trees	57
5	29	1	20	fs	highway	YPL (original)		grass/ mature trees	fs				mature trees	71
5	30	1	25	fs				shrub/ small trees	fs				mature trees	64
5	31	1	20	fs				mature trees	fs				mature trees	71

Field Analysis Using Densiometer

Methods

On August 30, 2005, Montana DEQ collected field measurements of riparian canopy density at some of the aerial photo sample sites using the EMAP method (Lazorchak, 2000). Sites were chosen for consistent vegetation composition between right bank and left bank, representative widths for the reaches, and site accessibility. Sites were chosen in the office from aerial photo analysis information and aerial photo review and adapted in the field based on encountered conditions. A densitometer was used to measure canopy shading on the stream at three cross-sections within the aerial photo sample site. Cross sections were located in the middle of aerial photo sample site, at an upstream location within the site, and at a downstream location within the site. For each cross-section, a densitometer reading was taken at the left bank, the right bank, and in the middle of the channel. All readings were taken with the densitometer at 1 foot above the water surface. All values were averaged to determine canopy density for the aerial photo site. (Lindgren, H., pers. comm., 2005)

Data

Table C-2. 2005 Densiometer Field Study

Reach	Field Canopy Cover	Field LB Vegetation	Field RB Vegetation	Active Channel Width
2-4	8%	shrub/small trees/grass on gravel bars	shrub/small trees/grass on gravel bars	120
2-8	12%	shrub/small trees	shrub/small trees	150
2-11	19%	road/grass/shrub	shrub/small trees	150
2-29	28%	bare/grass	mature trees	200
3-10	13%	rx/grass/shrub/ small trees	rx/grass	225
3-11	41%	grass/shrub/ small trees	trees	120
3-25	8%	grass/shrub/ small trees	grass/shrub/ small trees	210
3-26	34%	grass/shrub/ small trees	mature trees	190
4-21	34%	mature trees	shrub/small trees	135
5-11	54%	grass/shrub/ small trees	mature trees	75
5-13	44%	shrub/ small trees	shrub/ small trees	100
5-17	76%	mature trees	mature trees	30
5-29	81%	mature trees	mature trees	20

Discussion

In these analyses, canopy density is looked to as a surrogate for bank stability, and its link to properly functioning stream morphology and sediment loading. Additionally, although not specified as a pollutant on the 2006 list, temperature is also directly tied to canopy density as it effectively reduces the thermal loading to the stream. This relationship is especially important to the bull trout and westslope cutthroat trout in the watershed.

When reviewing the aerial photo analysis, it appears that on average, there is little distinguishable difference in canopy density from one reach to another (**Table C-3**). Mean canopy densities range from 43.4% - 56.4%. These canopy densities do not represent potential or historic conditions however as the Prospect Creek watershed has a legacy of alteration to the riparian corridors, especially lower in the watershed where valley width increases.

Table C-3. Aerial Photo Canopy Density Analysis Summary Table

Variable	Reach 2	Reach 3	Reach 4	Reach 5
Mean (%)	56.4	51	43.4	55.5
Minimum (%)	26.8	22	13.6	15.6
Maximum (%)	81.4	76.3	90.2	87.0
Sample Size	31	32	30	31

However limited in the number of sites that were field assessed, there is some information that can be gathered from the field verification study. As expected, in the field study canopy densities are higher in those areas dominated by mature riparian forest, which correlate to the upper, less disturbed areas of the watershed (Reach 5). This reach also has a more consistent relationship between the observed canopy density and the aerial photo interpretations for the field verified sites; 64% field derived mean canopy density for Reach 5, versus 57% interpreted mean canopy density.

Although the number of field verified sites is a small fraction of the total sites studied in the photo analysis, the similar results from both the field and remote exercise in Reach 5 allow for confidence in the results of the other photo interpreted Reach 5 sites. Reach 5 is further up the watershed and is characterized by riparian areas that are dominated by mature trees and smaller active channel widths (average width 46 feet). The mature tree riparian environment is the desired condition for the entire Prospect Creek watershed riparian corridor.

Lower in the watershed (Reaches 2-3) the relationship becomes significantly less between the results of the aerial photo interpretation and the actual observed field canopy density. Photo interpreted results show a mean canopy density of 59%, while field observed measurements show only 25% mean canopy density for the compared sites. Some of this discrepancy may be because the lower reaches are predominated by shrub/small tree and grass, the amount of canopy cover they provide may have been overestimated in the aerial photo analysis. However, because the relationship between the projected canopy percentages for mature trees in Reach 5 is consistent between the two methods, the assumption is made that those sites in the lower watershed that were identified as having mature trees on both banks is also similar to what we would expect if field verified. Nine sites were identified as having mature trees as the dominant

vegetation on both banks in the lower watershed. Mean canopy density as determined from aerial photo analysis at these sites is 62%.

The upper watershed (Reach 5) is predominantly characterized by mature tree composition and active channel widths less than 75 feet. Lower watershed reaches (2-4) are predominated by shrub/small trees and have an average active channel width of 169 feet and occur as wide as 375 feet. Since the mature tree dominated riparian area is the most desired condition, riparian canopy cover targets of 75% or better for upper reaches (reaches <75'), and riparian canopy cover of 60% or better for reaches >75'.

Table C-4. Comparison of DEQ Field Data and Aerial Photo Canopy Density Analysis on Mainstem of Prospect Creek

Reach-Site	Field Canopy Cover (%)	Aerial Photo Canopy Cover (%)	Field # of Threads	Aerial Photo # of Threads	Field LB Vegetation	Field RB Vegetation	Aerial Photo LB Vegetation	Aerial Photo RB Vegetation	Total Active Channel Width*
2-4	8	27	1	1	shrub/ small trees/grass on gravel bars	shrub/ small trees/grass on gravel bars	bare ground/ grass	bare ground/ grass	120
2-8	12	74	Middle xsection:2 Up and Down xsections:1	2	shrub/small trees	shrub/small trees	shrub/ small trees	shrub/ small trees	150
2-11	19 [†]	52	Upper and Middle xsections:2 Down stream xsection:1	1	road/shrub/ grass	shrub/ small trees	shrub/ small trees	shrub/ small trees	150
2-29	28	51	1	3	Bare ground/grass	mature trees	shrub/ small trees	shrub/ small trees	200
3-10	13	56	1	1	rx/grass/ small trees	rx/grass	bare ground/ grass	bare ground/ grass	225
3-11	41	76	1	2	grass/shrub/ small trees	mature trees	shrub/ small trees	shrub/ small trees	120
3-25	8 [°]	58	1 active	1	grass/shrub/ small trees	grass/shrub/ small trees	shrub/ small trees	shrub/ small trees	210
3-26	34	56	1	2	grass/shrub/ small trees	mature trees	shrub/ small trees	shrub/ small trees	190
4-21	34	34	DRY - readings are for potential canopy cover	1	mature trees	shrub/small trees	mature trees	shrub/ small trees	135
5-11	54	16	1	1	grass/shrub	mature trees	shrub/ small trees	shrub/ small trees	75
5-13	44	53	1 (side channel was dry)	2	shrub/small trees	shrub/small trees	shrub/ small trees	shrub/ small trees	100

Table C-4. Comparison of DEQ Field Data and Aerial Photo Canopy Density Analysis on Mainstem of Prospect Creek

Reach-Site	Field Canopy Cover (%)	Aerial Photo Canopy Cover (%)	Field # of Threads	Aerial Photo # of Threads	Field LB Vegetation	Field RB Vegetation	Aerial Photo LB Vegetation	Aerial Photo RB Vegetation	Total Active Channel Width*
5-17	76	87	1	1	mature trees	mature trees	mature trees	mature trees	30
5-29	81	71	1	1	mature trees	mature trees	mature trees	mature trees	20

* Values from Aerial Photo Analysis

† 2-11: Large variability from 1996 photo

∞ 3-25: Power line disturbance

The history of logging and the development of infrastructure (roads, powerlines, etc) in the area have altered riparian corridors throughout the watershed. Literature shows restoring the riparian corridor, where appropriate, will improve stream morphology and habitat and is the only identified effective means for reducing temperature in the Prospect Creek watershed. If the riparian canopy targets are met, over time, lower width/depth ratios will likely also result producing smaller but deeper channels which improve habitat conditions for sensitive fish species. Additionally, the amount of surface area of the stream will be reduced also helping to reduce temperature, and allow the stream to recruit more woody debris which in turn produces more complex habitat through the development of varied morphology, more and deeper pools, and increased diversity in macroinvertebrate habitat.

It is acknowledged that this study and the resulting recommendations are based on very limited data and statistical analysis. Further verification of riparian conditions in the field is strongly recommended, as well as assessment of riparian potential. Due to the presence of utility corridors and infrastructure in the watershed it is also recognized that these riparian goals may not always be achievable. It is understood that it will take many years or decades to completely accomplish these recommendations, however the analysis of the riparian corridors and investigation into alternative management options where the riparian areas coincide with infrastructure, should be one of the first steps to achieving the TMDL for Prospect Creek watershed.

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